Blind Bidding Negotiation Support System for any Number of Issues

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 USC 119(e) on US Provisional Patent Application No. 60/256,935 filed December 21, 2000.

BACKGROUND OF THE INVENTION

1. Field of the Invention

1. The present invention relates in general to a computer-based decision support system for multiple parties involved in any type of negotiation. In complex negotiations, the system assists parties in reaching an agreement that optimizes the individual and overall benefit to the parties.

2. Description of the Background Art

2. Negotiation is a process where two or more parties with conflicting objectives attempt to reach an agreement. This process includes not only bargaining--the presentation and exchange of proposals for addressing particular issues--but also the attempts by each party to discover and use knowledge of the preferences, strengths and weaknesses of their opponents to reach a resolution that maximizes their own objectives while still being acceptable to other parties. Negotiating parties may be individuals or teams representing their own interests or the interests of their organizations. When there is at least some willingness to engage in negotiation, it can be a constructive alternative to other means (e.g., violence, litigation, stalemate) of settling disputes.

3. Negotiators have several basic tasks, which are non-trivial when many issues are involved:

Qualify Interests	Identify potential agreements that will be acceptable to all parties.
Quantify Satisfaction	Determine how each party would become satisfied on each of the issues.
Establish Equity	Agree on how the benefits should be divided among the parties.

Maximize Benefits	Find an outcome that maximizes the mutual benefits for the parties.
Secure Commitment	Insure that the agreement will be implemented as expected.

4. In order to accomplish these tasks, negotiators must explore the impacts of various decisions, and at least begin to understand the tradeoffs among these impacts. A third party mediator or facilitator may be included in a negotiation process to help manage the interactions and make suggestions for negotiating parties to consider. Alternatively, an arbitrator may be involved with the power to draft and perhaps dictate settlements for the parties. It is commonly recognized that such disinterested parties can significantly help negotiators in their quest for an agreement.

5. Recent developments in modeling negotiation processes, more powerful computers, and the maturing of the Internet are motivating work in the use of computer-based analyses and network solutions for complex negotiation problems. State-of-the-art interactive interfaces today permit the updating of issues, preferences, and interested stakeholders as the negotiation process proceeds.

6. The current literature on interactive computer programs for multi-objective conflict resolution commonly uses the term Negotiation Support System. This term refers to the special type of group decision support system designed for providing assistance in situations where there is disagreement and conflict among various parties as to what decisions to adopt. Research addressing group decision making in multi-objective situations is in its third decade, yet the development and use of Negotiation Support Systems to facilitate and help guide multi-party negotiations is still considered a relatively new field.

7. Negotiation Support Systems can be categorized according to their functions either as negotiation preparation systems, supporting a pre-negotiation strategic planning stage, or negotiation information management systems, facilitating negotiations in real time. Negotiation information management systems can be further classified as either context support systems or process support systems. Context models focus on the behavior of the system being designed, managed or operated. Such models are used to answer questions about the performance of the system given any particular decision regarding its design, management or operation. Process models are concerned with the dynamics or procedure of the negotiation process that includes

how a group of parties with differing and conflicting objectives can reach an acceptable agreement.

8. Numerous efforts are underway in each of the various kinds of Negotiation Support Systems described above. Of particular interest here are process support systems. These systems are designed to provide a practical means of increasing the likelihood of mutually agreeable settlements when a potential region of agreement exists. Sometimes they can help identify better solutions than would have been found without their use. The majority of process support systems described in the literature for complex negotiations, are still in the conceptual stage, or, at best, play a relatively passive role in the negotiation process. There are some working systems that are single workstations that support a professional mediator rather than the negotiating parties directly. The one prior art process support system that stands out in its ability to substantially aid negotiating parties in a complex real-world setting is **ICANS**, as described in US Patent 5,495,412 and presently implemented in **SmartSettle** (www.**SmartSettle**.com).

9. There are also some other very simple existing systems for automated single-issue blind bidding (CyberSettle (www.cybersettle.com), ClickNsettle (www.cybersettle.com) and a number of others (http://www.ombuds.org/center/aaron/adronline2001/01/january_op-ed.htm). The other blind bidding systems all have one thing in common, in that they take proposals from each party and split the difference according to some agreed formula when proposals are close enough. These systems seem to have at least two drawbacks:

- Parties must understand what formula is used for splitting the difference and make an extra calculation of what they might actually be agreeing to before making a proposal.
- These systems are apparently not scalable to more than one issue.

10. A general problem in negotiations involving multiple issues is finding an optimal agreement in light of complexity and different confidential preferences of the negotiating parties.

BRIEF SUMMARY OF THE INVENTION

11. A computer-based interactive blind-bidding system for supporting negotiations is disclosed. The method described here improves upon that described as **ICANS** in Patent 5,495,412. In this system, issues are created with each negotiating party indicating preferred

outcomes for each issue. Parties can then create proposals and other potential agreements within those ranges, which may be visible to other parties or not, at their own option. When requested by the parties, the system generates visible potential agreements whose values are derived on the basis of preference information provided by the parties. If some potential agreements already exist, newly generated potential agreements fall between the existing ones in terms of satisfaction levels. In this system, parties can see the potential agreements suggested by the system, but are "blind" to a confidential acceptance that any other party can indicate with respect to any package. Two or more parties reach an agreement when they accept the same potential agreement.

12. In general, the disclosed system assists any number of parties involved in simple or complex negotiations with any number of issues in reaching an agreement that optimizes both the individual and overall benefit to the parties. The parties begin by collaborating in building a Framework for Agreement. The Framework for Agreement may include constraints that relate two or more issues. From the Framework for Agreement, a list of issues can be derived and entered into a computer system. Each of the parties to a conflict or dispute to be negotiated then enters their own preferences concerning each issue of the conflict into the computer system. They may also enter private issues and/or private constraints if this provides a better problem description.

13. If desired, each party to the dispute can have a separate computer system so that each party's preference information remains confidential to that party. The preference information includes data on satisfaction functions for each of the issues. Each satisfaction function defines a party's relative level of satisfaction as a function of a numerical value for the outcome of that issue. The preference information for each party includes more preferred and less preferred outcomes that define bargaining ranges and a relative importance assigned to each issue with respect to its bargaining range. With bargaining ranges defined, packages (sets of issue values) can be identified, each such package being a potential agreement. Every package that is created by any party or by the system is associated with a specified level of satisfaction or rating for each party that is determined by the issue satisfaction functions and relative importances. Each party has a private view in which packages are rated according to their own preferences.

14. Parties may create any number of private packages of issue values for their own consideration. The system may also generate one or more packages as potential agreements that,

in terms of satisfaction levels, fall within bargaining ranges by the parties. In the remainder of this description and in the included illustrations, this type of package is referred to as a **Suggestion**. To assist a party in evaluating their own preferences, the system may generate one or more packages that are equivalent to other packages, i.e., provide approximately the same level of satisfaction to a party as other packages. Each party may also enter one or more packages of issue values that are published as proposed agreements (i.e. for other parties to see). If two or more parties have made proposals or have accepted packages that are close enough to each other (in terms of satisfaction levels), the system may generate another single package that simultaneously satisfies all parties by providing approximately the same level of satisfaction as their current proposals would provide. Parties may accept, in confidence, any package, including any **Suggestion** generated by the system that is displayed on their private view. If two or more parties accept the same package, that package becomes a tentative agreement among those parties.

15. Packages that are generated by the system are done so using optimization techniques, the preferred method using standard mixed-integer linear programming techniques to solve an appropriate optimization problem that takes into account the preference information of the parties and obeys any shared or private constraints that have been defined. "Minimizing the maximum gain" between existing proposals and a generated package is one technique that may be used to generate an equivalent package for two or more parties. Once parties have reached a tentative agreement by any means, parties may elect to have an optimal agreement to the conflict determined, again using linear programming techniques, by "Maximizing the minimum gain" in satisfaction achieved by each of the parties in going from the tentative to an improved package of issue values. This will, at the same time, maximize the overall benefit to all of the parties. For maximum security of all party's confidential information, a separate computer system located at a neutral site can be connected to each individual party's computer system. In this case, packages are generated at the neutral site and transmitted back to each party's own computer system. Encryption is used to maintain transmission security. This entire system may be automated in repetitive negotiations in which the computer systems controlled by the parties may derive required input information from simulation models rather than that information having to be explicitly entered each time.

16. The main advantage of the disclosed system over previous systems is that it allows decision makers to use blind bidding (where acceptances are blind) to quickly reach an agreement in a negotiation involving any number of issues. It is also superior to other methods of blind bidding, even with single issues, because it does not require any "split-the-difference" formula. By its very nature, multi-issue blind bidding based on the preferences of the negotiators tends to produce agreements that are closer to optimal than other methods.

BRIEF DESCRIPTION OF THE DRAWINGS

17. The figures in the following list appear as drawings referred to in the detailed description and in the illustration appended to the detailed description. The illustration is a hypothetical negotiation between two parties named **BigCo** and **Sally**. Several scenarios are presented in order to illustrate the most preferred embodiments of the method and assist the reader to completely understand the invention. Scenario IA illustrates a more conventional method of negotiation, in which parties consider visible proposals. The result is optimized in a post-settlement analysis (Scenario IB) (as described in **ICANS** patent). Scenarios II and III illustrate how multi-issue blind bidding is implemented with **SmartSettle**. In Scenario II parties both accept the same **Suggestion**. This becomes a tentative agreement and the result is subsequently optimized to find improvements. In Scenario III, the **Equivalent Suggestion** is first used to solve an invisible impasse that parties have reached in the blind bidding process. Each Figure is associated with a code that refers to the party view, scenario, and the figure sequence number within that scenario. For example, SS1 means "Sally Start 1", SIA1 means "Sally Scenario IA 1", and SM1 means "Sally Middle 1".

Introduction

Fig 1. (INTRO) Shared Information view is the same for both parties.

Sally's Viewpoint

Fig 2. (SS1) Flexibility is implied with optimistic proposals from each party.

Fig 3. (SS2) Relative importance for each issue creates package ratings.

Fig 4. (SIA1) Concessions bring parties closer together.

Fig 5. (SIA2) Parties reach impasse on **Promotion** issue.

Fig 6. (SIA3) **Sally** accepts **BigCo**'s last Proposal.

Fig 7. (SIA4) Tentative agreement is reached when **Sally** accepts **BigCo** Proposal.

Fig 8. (SIB1) **Sally** defines satisfaction graph for three **Promotion** options.

Fig 9. (SIB2) **Sally** defines satisfaction graph for **Project Budget** issue.

Fig 10. (SIB3) **Compensation/Promotion** tradeoffs are defined with Even Swap 1.

Fig 11. (SIB4) **Compensation/Budget** tradeoffs are defined with Even Swap 2.

Fig 12. (SIB5) **Sally** analyses included packages.

Fig 13. (SIB6) Preference analysis adjusts relative importance to produce equivalent ratings.

Fig 14. (SIB7) **Tentative** agreement rating is revised after preference analysis.

Fig 15. (SIB8) Generated **Improvement** (at 320) is better than previous **Tentative** (at 270).

Fig 16. (SM1) First of five **Suggestions** is midway between proposals.

Fig 17. (SM2) **Sally** accepts **SmartSettle Suggestion 5**.

Fig 18. (SII1) **Tentative** agreement is reached when **Sally** and **BigCo** both accept **Suggestion 5**.

Fig 19. (SII2) **Improvement 6** (at 242) is better for **Sally** than **Suggestion 5** (at 220) (before preference analysis).

Fig 20. (SII3) **Improvement 6** (at 325) is still better for **Sally** than **Suggestion 5** (at 306) (after preference analysis).

Fig 21. (SII4) **Improvement 7** (at 350) is better for **Sally** than **Improvement 6** (at 325).

Fig 22. (SIII1) Parties do not know that they are at this impasse.

Fig 23. (SIII2) Generated **Equivalent 6** satisfies both parties (at 220 for **Sally**).

Fig 24. (SIII3) After preference analysis, **Equivalent 6** actually appears slightly worse than Suggestion 5.

Fig 25. (SIII4) **Improvement 7** (at 323 for **Sally**) is better than **Equivalent 6** (at 304).

BigCo's Viewpoint

Fig 26. (BS1) Flexibility is implied with optimistic proposals from each party.

Fig 27. (BS2) Relative importance for each issue creates package ratings.

Fig 28. (BIA1) Concessions bring parties closer together.

Fig 29. (BIA2) Parties reach impasse on **Promotion** issue.

Fig 30. (BIA3) **Tentative** Agreement is reached when **Sally** accepts **BigCo** proposal.

Fig 31. (BIB1) **Compensation/Promotion** tradeoffs are defined with Even Swap 1.

Fig 32. (BIB2) **Compensation/Budget** tradeoffs are defined with Even Swap 2.

Fig 33. (BIB3) Preference analysis adjusts relative importance to produce equivalent ratings.

Fig 34. (BIB4) **Tentative** agreement rating is revised after preference analysis.

Fig 35. (BIB5) Generated **Improvement** (at 115) is better than previous **Tentative** (at 90).

Fig 36. (BM1) **BigCo** accepts **SmartSettle Suggestion 3.**

Fig 37. (BM2) **BigCo** has accepted **Suggestions** 1, 3 & 5 (white dots).

Fig 38. (BII1) **Tentative** agreement is reached when **Sally** also accepts **Suggestion 5.**

Fig 39. (BII2) Improvement 6 (at 108) is better for **BigCo** than **Suggestion 5** (at 93) (before preference analysis).

Fig 40. (BII3) **Improvement 6** (at 88) is still better for **BigCo** than **Suggestion 5** (at 69) (after preference analysis).

Fig 41. (BII4) **Improvement 7** (at 100) is better for **BigCo** than **Improvement 6** (at 88).

Fig 42. (BIII1) Parties do not know that they are at this impasse.

Fig 43. (BIII2) Generated **Equivalent 6** satisfies both parties (at 125 for **BigCo**).

Fig 44. (BIII3) After preference analysis, **Equivalent 6** appears better than **Suggestion 1**.

Fig 45. (BIII4) **Improvement 7** (at 114 for **BigCo**) is better than **Equivalent 6** (at 105).

DETAILED DESCRIPTION OF THE INVENTION

Overview

18. The present invention improves one aspect of the previously described **ICANS** (US Patent 5,495,412) negotiation process support system with a new method called multi-issue blind bidding. The multi-issue blind bidding method is described here in the wider context of the original **ICANS** method (Scenarios IA and IB) in order to illustrate the most preferred embodiment of the method and assist the reader to completely understand the invention. The disclosed system has recently been implemented by a release of **SmartSettle** at www.smartsettle.com and will be referred to by that name throughout this description.

19. In general, **SmartSettle** is implemented on a computer by providing the negotiating parties with an acceptable interactive graphical interface. It assists any number of parties involved in simple or complex negotiations with any number of issues in reaching an agreement that quickly produces an optimal agreement, maximizing the joint benefits of all parties. If desired, each party to the dispute can have a separate computer system in a network with a neutral site so that each party's preference information remains confidential to that party.

20. As with **ICANS**, **SmartSettle** requires parties to first collaborate in building a Framework for Agreement. The Framework for Agreement may include constraints that relate two or more issues. From the Framework for Agreement, a list of issues can be derived and entered into a computer system. The system then needs to elicit at least a minimum amount of preference information from each party for the purpose of creating mathematical representations of preferred outcomes, bargaining ranges and satisfaction ratings for potential agreements. Parties may also enter private issues and/or private constraints if this provides a better problem description. With preferences well represented, **SmartSettle** is able to generate **Suggestions** and other packages on which parties can place a confidential acceptance. When two parties accept the same package an agreement is declared.

Preferences Required for Package Evaluation

21. Before parties can enter information regarding their preferences on the outcome of a particular issue, a range of acceptable outcomes for that issue from less desirable to more desirable must be defined. This range is referred to here as a bargaining range. Within this range,

SmartSettle, by default, generates a linear relative satisfaction function to define that party's relative level of satisfaction as a function of a numerical value for the outcome of that issue. However, the party has the option of changing that function to more accurately describe their relative satisfaction function by picking points on the graphical interface (Fig 8, Fig 9).

22. With bargaining ranges defined, packages (sets of potential decision values for each unresolved issue) can be identified, each such package being a potential agreement. Every package that is created by any party or by the system is associated with a specified level of satisfaction or rating for each party that is determined by the issue satisfaction functions and relative importances. Each party has a private view in which packages can be evaluated according to their own preferences.

Preference Elicitation and Analysis Methods

23. **SmartSettle** provides four distinct ways for each party to define the satisfaction tradeoffs between issues that determine the relative importance of each issue with respect to its bargaining range. Two of these ways involve comparisons of additional satisfaction associated with bargaining ranges. The additional satisfaction associated with bargaining ranges can either be defined as being equivalent or can be rated relative to each other. The other two ways involve comparisons of the satisfaction levels of two or more packages. In this case, packages can either be defined as being equivalent to one another (Fig 10, Fig 11, Fig 31, Fig 32), or can be rated relative to each other. **SmartSettle** analyzes this information to assist parties in forming a more accurate preference representation (Scenario IB, Fig 19, Fig 20, Fig 39, Fig 40, Fig 24, Fig 44).

24.

Types of Packages

25. **SmartSettle** uses the ranges, satisfaction functions and satisfaction tradeoff information to generate a rating that represents the relative total satisfaction value that each package will provide the party. Once **SmartSettle** has sufficient information with which to rate packages, parties can create packages that may be private or published for other negotiators to see. Published packages may be declared as proposals or for discussion purposes. Parties may also select from a menu, any one of several different types of packages for **SmartSettle** to generate; **Split**, **Suggestion**, **Equivalent**, **Improvement**, or **Dominant**. Except for **Equivalent**, each of

these functions always simultaneously generate an identical package for all parties, defined as follows:

- **Split**: a generated package that provides each party as close as possible to, but not less than, the average of the satisfaction ratings of existing party proposals.
- **Suggestion**: a generated package that falls between other existing packages (proposals and other **Suggestions**) in terms of satisfaction ratings to each viewing party (Fig 16).
- **Equivalent**: a generated package that is equivalent, in terms of satisfaction ratings, to a party's least preferred acceptable package but different enough, in terms of issue values, to allow a party to check their preferences. If two or more parties have made proposals or have accepted packages that are close enough to each other (in terms of satisfaction levels), the system may generate an **Equivalent** that simultaneously satisfies all parties by providing approximately the same level of satisfaction as their current proposals would provide. With confidential acceptances, this functionality allows the system to solve visible or invisible impasses (Fig 22, Fig 42). Whether or not **SmartSettle** has generated different packages for all parties, or the same identical package for all of them, is not revealed to the parties unless it becomes an agreement through acceptance (Fig 23, Fig 43).
- **Improvement**: a generated package that is better than the tentative agreement for at least one party and not worse for any others and falls on the efficiency frontier.
- **Dominant**: a generated package that falls on the efficiency frontier. This outcome of this procedure is the same as if a **Split** had first been generated and then an **Improvement**.

Multi-issue Blind Bidding

26. While other systems take a series of proposals (bids) from parties and keep them hidden, the present invention takes published (visible) proposals (Fig 2, Fig 26) or bargaining ranges and responds with visible potential agreement packages (Fig 16) that are generated as a function of user preferences as described above. Parties can see the packages that are generated by **SmartSettle**, but are "blind" to a confidential acceptance that any party can indicate with respect to any package (Fig 17, Fig 36, Fig 37). When two or more parties accept the same package, an agreement is declared between those parties (Fig 18, Fig 38). This is what is defined as the multi-

issue blind bidding method. When this method is applied to a single-issue negotiation, it has an advantage over other methods, in that parties can see exactly what they are agreeing to and do not need to understand any "split the difference" formula before making proposals.

27. Multi-issue blind bidding, as defined in this document, has a very desirable characteristic in that it tends to produce agreements that already fall close to the efficiency frontier, even without post-settlement optimization. The more **Suggestions** there are that are being considered, the better the result, in terms of being optimal.

Optimization Methods

28. Whenever **SmartSettle** generates any type of package, it does so by solving an appropriate optimization problem. The preferred method is to use standard mixed-integer linear programming techniques to solve an appropriate optimization problem that takes into account the preference information of the parties and obeys any shared or private constraints that have been defined. **Split** and **Equivalent** both use an algorithm referred to as "Minimizing the Maximum Gain" between existing proposals and a generated package. **Improvement** and **Dominant** both use an algorithm referred to as "Maximizing the Minimum Gain". In this method, once parties have reached a tentative agreement by any means, parties may elect to have an optimal agreement to the conflict determined by "maximizing the minimum gain" in satisfaction achieved by each of the parties in going from the tentative to an improved package of issue values (Fig 25, Fig 45). This will, at the same time, maximize the overall benefit to all of the parties. For further details regarding those algorithms, see the description for US Patent 5,495,412 (**ICANS**).

29. Multi-issue blind bidding is implemented in **SmartSettle** with a routine called **Suggestion**. The objective of the **Suggestion** model is to find a package that comes as close as possible to the center of the largest gap between existing packages, as defined by the average size for all parties.

30. Preferably, since each of the parties to the negotiations normally wish to have their preferences kept confidential from each of the other parties, a separate computer system and associated graphical interface are necessary for each of the parties so that they can enter their preference information separately and confidentially. The separate computer systems can be programmed to carry out all of the initial calculations including generation of the relative

satisfaction functions for each issue and generation of the total satisfaction for each package. This information can then be transmitted to a central computer system at a neutral site which processes all of the preference data from each of the parties, uses this information to generate requested packages, and transmits the results back to each of the parties. Encryption is used to maintain transmission security. This entire system may be automated in repetitive negotiations in which the computer systems controlled by the parties may derive required input information from simulation models rather than that information having to be explicitly entered each time.

Illustration

31. The illustration that follows refers to the figures in the drawings section. The illustration is a hypothetical simple two-party workplace negotiation between an employee named **Sally** and her employer, **BigCo**. Several scenarios are presented in order to illustrate the most preferred embodiments of the method and assist the reader to completely understand the invention. Scenario IA illustrates a more conventional method of negotiation, in which parties consider visible proposals and one accepts a proposal made by the other. In Scenario IB, parties use **SmartSettle**'s advanced preference analysis and optimization features to search for improvements to the agreement reached in Scenario IA (as described in **ICANS** patent).

32. Scenarios II and III illustrate how multi-issue blind bidding is implemented with **SmartSettle**. In Scenario II, which starts the same way as Scenario I, parties both accept the same **Suggestion**. This becomes a tentative agreement and the result is subsequently optimized to find improvements. In Scenario III, an **Equivalent** package is generated to solve an invisible impasse that parties have reached in the blind bidding process.

33. The text of the illustration is written primarily from **Sally**'s viewpoint, although the figures show screenshots from both party's point of view. The scenarios that follow are organized as follows:

Introduction

- Start
- Scenario IA (continued from Start)
- Scenario IB (continued from Scenario IA)
- Middle of Scenarios II & III (continued from Start)
- Scenario II (continued from Middle)
- Scenario III (continued from Middle)

Introduction

34. Case Description: **Sally** is not feeling very good about her job situation. She claims discrimination and is feeling criticism for inadequate performance but says that low project funding is the main problem. **Sally** now wants a **Promotion** as well as an increase in **Project Budget** for the next fiscal year. **BigCo** would rather just settle this with a small lump sum **Compensation** and have the case go away.

35. In the preparation phase, the parties and their facilitator(s) meet face-to-face, or on the Internet with **SmartSettle**'s electronic brainstorming tools to share interests and build a **Framework for Agreement.** A **Framework for Agreement** is like a draft of the final agreement except with blanks representing unresolved issues. In real cases, the **Framework for Agreement** and corresponding list of issues usually evolve during the course of negotiations. In this simple illustration, the issue list will remain fixed as listed here.

- Compensation Lump Sum ($)
- Promotion (None, Position A, Position B)
- Project Budget ($1000)

36. Fig 1 shows how the **SmartSettle Shared Information** window appears after the information about parties and issues has been entered. This screen appears the same to both parties.

37. Each negotiator also has a private view, which is determined by their own preferences. Following is a comprehensive description of the negotiation process written from the viewpoint

of **Sally**. For comparison, reference is also made to figures showing corresponding screen shots taken from **BigCo**'s viewpoint.

Start (same for all scenarios)

38. The **SmartSettle** process encourages parties to begin with optimistic proposals and be prepared to be flexible. Bargaining ranges are established in this way. A bargaining range delineates possible outcomes for a particular issue. Unless explicitly constrained by the parties, it is always possible for the negotiation to move outside initially defined ranges on any particular issue. Shown in Fig 2 are the first optimistic proposals from each party as seen from **Sally**'s viewpoint (**BigCo** viewpoint in Fig 26). **Sally**'s least preferred outcome, which in this case is also **BigCo**'s first proposal, is displayed on the left-hand side. **Sally**'s most preferred outcome, her own optimistic proposal in this case, is displayed on the right-hand side. Packages are displayed in different colors in order to provide contrast for the viewer.

39. A package is any complete set of decisions that could become the final agreement. Technically, a package is really a **Framework for Agreement** with all the blanks filled in. In **SmartSettle**, a package is represented with a set of issue values. Packages typically encountered with **SmartSettle** include a proposal, a concession, a suggestion, a split, an equivalent, a tentative solution, an improvement, and the final agreement. The piecemeal dilemma vanishes when negotiators no longer need to negotiate issue-by-issue in order to deal with complexity. A white dot beside any package (beside **Sally 1** in Fig 2 and **BigCo 1** in Fig 26) indicates acceptability to the viewing party. The "?" marks indicate that packages cannot yet be rated because **Sally** has not specified relative issue importance. Importance of an issue is a measure of how much satisfaction could be gained or lost on that issue, given best and worst outcomes for that issue and assuming certain outcomes on other issues. Importance ratings are always relative. You could double all the numbers and nothing would change. **Sally** will next specify relative issue importance.

40. Given her current tight financial situation, **Sally** feels that **Promotion** by itself is only half as important as immediate **Compensation**. On the other hand, she would be willing to give up a lot to be in control of a larger **Project Budget**, which she considers twice as important as **Compensation**. Along these lines, as shown in Fig 3, relative to **Compensation** being worth an

arbitrary **100** points, **Sally** assigns **50** points to **Promotion** and **200** points to **Project Budget** (**BigCo** relative importance shown in Fig 27).

41. After issues have been assigned a relative importance, each package will have a rating between some low value (typically zero) associated with the least preferred package, and a high value (in this case, the total importance contributed by all issues) associated with a most preferred package. If you add together the number of points assigned to each issue (**100** + **50** + **200**), the total is **350**, which becomes the rating of the most preferred package. In this way, the rating of any package, that can be displayed within the defined ranges, will fall between **0** and **350**.

Scenario IA (continued from Start)

42. Fig 4 (Fig 28 from **BigCo** viewpoint) shows how the screen looks after each party has made several concessions. They are closer on **Compensation** and **Project Budget** but neither party has budged yet on the **Promotion** issue.

43. In the concessions that follow, **Sally** agrees with **BigCo** on **Project Budget** and then **BigCo** makes a proposal that agrees with **Sally** on **Compensation** but not on **Promotion**. Shown in Fig 5 (Fig 29 from **BigCo** viewpoint) are the last two proposals, with **BigCo**'s last proposal displayed on top.

44. In Fig 6, **Sally** is shown accepting **BigCo**'s last proposal.

45. When **Sally** accepts **BigCo**'s last proposal **(BigCo 5)**, the white dot changes to green (indicating that both parties have accepted). **BigCo 5** moves to a new group named **Tentative** as shown in Fig 7 (Fig 30 from **BigCo** viewpoint) and this scenario comes to a happy ending.

46. The above has illustrated a simple way to use **SmartSettle**. Guided by ratings derived from minimal preference information, parties made a series of visible concessions and reached an outcome that they were both satisfied with. However, as you will see in the Scenario IB, it turns out that these negotiators have actually left significant value on the table.

Scenario IB (continued from Scenario IA)

47. Scenario IB continues where Scenario IA leaves off. **Sally** and **BigCo** now wish to improve their existing **Tentative** solution. They could simply ask **SmartSettle** to generate an

Improvement now. However, encouraged by their facilitator(s), parties first spend some time fine-tuning their preferences.

48. **Sally** first considers each issue individually. Shown in Fig 8 is the **Satisfaction Graph** for the **Promotion** issue. **Sally** has adjusted the height of the bars to show how much relative satisfaction would be gained by each option. This graph shows that, compared to **Position B**, **Position A**, set at 30%, is not much better than no promotion at all.

49. **Sally** next considers the **Project Budget** issue. After some discussion with her facilitator, it becomes clear that a given increase in **Project Budget** would provide more satisfaction at lower values than at higher values. They create a satisfaction function shape such as that shown in Fig 9 to represent how **Sally** becomes satisfied on this issue. To exactly recreate the results of this illustration yourself, plot three points for (Satisfaction, Project Budget) at (32, 52), (58, 66) & (82, 83).

50. **BigCo** does change **SmartSettle**'s linear defaults for any the satisfaction graphs in this example.

51. **Sally** now reconsiders the relative importance between issues. Even though the concepts of importance and ratings may seem to be straightforward, many people are surprised to find that an even swaps exercise, as described below, is very helpful in fine-tuning their preferences.

52. In Fig 10, two packages are displayed. The package named **Reference** (with values 7000, Position A and 70) happens to be the same as the current Tentative agreement. To minimize the effects of possible interdependencies, it is recommended to define tradeoffs around a prediction of final outcome values. The package named **Swap 1** (with values 9000, none and 70) is different, but **Sally** considers it equally satisfactory to the **Reference** package. To define this equivalent package, **Sally** has identified an even swap between **Compensation** and **Promotion.** **Compensation** at **$9000** and a **Promotion** at **none** would be equally satisfactory to **Compensation** at **$7000** and **Promotion** at **Position A**. In other words **Sally** considers $2000 of **Compensation** an even swap for **Position A**. The package ratings, however, do not reflect this fact, which confirms the need for this analysis.

53. **Sally** has also identified an even swap (**Swap 2** in Fig 11) between **Compensation** and **Project Budget**. **Compensation** of **$3000** and a **Project Budget** of **$80,000** would be equally satisfactory to a **Compensation** of **$7000** and a **Project Budget** of **$70,000**. In others words, **Sally** considers $4000 of **Compensation** an even swap for $10,000 of **Project Budget**.

54. Having indicated which packages to include in preference analysis, **Sally** now chooses to **Analyze Included Packages**. Fig 12 shows her choosing this menu item from the **Preferences** menu.

55. For the sake of illustration this illustration assumes that **BigCo** happens to fine-tune **SmartSettle**'s representation of their preferences at the same time as **Sally** does. **BigCo**'s even swaps are illustrated in Fig 31 and Fig 32.

56. Keeping the relative importance for **Compensation** constant at 100, **SmartSettle** adjusts the relative importance for the other two issues in such a way that all three packages have identical ratings as shown in Fig 13 (Fig 33 from **BigCo** viewpoint).

57. All packages now take on slightly different ratings that more precisely reflect the true preferences of each party (Fig 14 in **Sally**'s view, Fig 34 in **BigCo**'s view). In particular, given the satisfaction units fixed relative to the **Compensation** range being worth 100 points, you can see, if you refer back to Scenario IA, that **BigCo 5** is actually worth more than originally estimated.

58. With preferences now well represented, **SmartSettle** is able to generate a package named **Improvement 1**, which produces more satisfaction for both parties and becomes the final solution. Notice in Fig 15 that **Improvement 1** (rated at **320**) is worth significantly more to **Sally** than **BigCo 5** (now rated at **270**). In **BigCo**'s viewpoint you will see that **Improvement 1** is also much better for them (Fig 35).

Middle of Scenarios II & III (continued from Start)

59. This scenario starts with parties making the same first optimistic proposals as in Scenario I. It then shows how parties can use the **SmartSettle Suggestion** method (multi-issue blind bidding), which lets them skip the concession phase and go straight to a tentative solution. Either party, at any time, can request any number of **Suggestions** to be generated by **SmartSettle** between the last proposals made by each party. Parties can choose to accept any of these packages in confidence. In this way, parties can indicate how much they are willing to concede, without revealing that to the other party. If they both accept the same package, it becomes a tentative deal from which they can continue to look for improvements if they wish.

60. Five **Suggestions**, named **Suggestion 1** through **Suggestion 5**, are generated. As shown in Fig 16, the first one, **Suggestion 1**, rated at **175**, is midway between the proposals made by each party.

61. In Fig 36, **BigCo** is about to accept **Suggestion 3**. In Fig 37, **BigCo** has accepted **Suggestion 1**, **Suggestion 3** and **Suggestion 5**.

62. In Fig 17, all five **Suggestions** are being displayed at the same time. **Suggestion 2** and **Suggestion 4** have already been accepted by **Sally,** as indicated by a white dot beside each of those packages. **Sally** is about to also accept **Suggestion 5**.

63. Neither party knows which **Suggestions** have been accepted by the other party.

Scenario II (continued from Middle)

64. When **Sally** accepts **Suggestion 5**, it moves to a new group named **Tentative**, as shown in Fig 18 (Fig 38 from **BigCo** view), and the white dot changes to green. This means that **BigCo** had also accepted this package and they have a **Tentative** agreement.

65. Parties now ask for an **Improvement** to be generated. As shown in Fig 19, **Improvement 6** (rated at **242**) is better for **Sally** than **Suggestion 5** (rated at **220**), which was the previous **Tentative**. Although parties already had a tentative solution, they both preferred and accepted the **Improvement**, which became the new agreement (Fig 39 shows this results in **BigCo**'s view).

66. In this scenario, relatively cooperative parties reached a good agreement quite quickly, even without advanced preference analysis. Since the process so far has been extremely easy. **Sally** and **BigCo** still have plenty of energy left. Therefore, let's have them continue on and see what they're still missing. Fig 20 (Fig 40 in **BigCo** view) shows how relative importances and ratings are adjusted after fine-tuning preferences (with the method shown in Scenario IB). We now see that for **Sally**, given that the **Compensation** range is fixed at 100 relative satisfaction points, **Improvement 6** (now rated at **325**) is actually worth more than originally estimated. **Suggestion 5** (now rated **306**) is also worth more but is still inferior to **Improvement 6**.

67. However, when **SmartSettle** generates **Improvement 7** (shown rated at **350** for **Sally** in Fig 21 and at **100** for **BigCo** in Fig 41), the parties are pleasantly surprised to find that **SmartSettle** has discovered more value for each of them.

68. Scenario III, which follows, illustrates what **SmartSettle** can do to help in more difficult circumstances.

Scenario III (continued from Middle)

69. This scenario starts off the same way as Scenario II. However, in this case, **BigCo** does not accept **Suggestion 5**. Instead of an easy agreement, it seems that parties are stuck. In situations like this, if parties are not too far apart, **SmartSettle** can solve the apparent impasse. It does this by finding a single package that is equivalent in terms of satisfaction to each party's least preferred accepted package, which in this case, for **Sally**, is **Suggestion 5**. If you have already reviewed this simulation from **BigCo**'s point of view, you will know that **BigCo**'s least preferred accepted package is **Suggestion 1.** The resulting impasse is displayed in Fig 22 (Fig 42 in **BigCo** view). Of course neither party knows this.

70. To solve the impasse, **SmartSettle** generates another package, named **Equivalent 6**. Since this package simultaneously satisfies both parties, it becomes a **Tentative** agreement. In **Sally**'s view, as shown in Fig 23, **Equivalent 6** has the same rating as **Suggestion 5** even though it has different issue values. In **BigCo**'s view, shown in Fig 43, **Equivalent 6** has the same rating as **Suggestion 1**.

71. If you've read the other scenarios, you've seen that it can be quite beneficial to fine-tune preferences prior to generating improvements. Fig 24 shows how **Sally**'s screen appears after preference analysis (as in Scenario IB). Relative importances have been adjusted relative to **Compensation** fixed at 100 points. After package ratings are also revised, both **Equivalent 6** and **Suggestion 5** are worth more, but **Equivalent 6** is actually worth a bit less to **Sally** than **Suggestion 5** (although evidently not enough to prevent it from having been accepted earlier).

72. An impasse is often described as a win-lose situation when neither party is willing to give in (or even lose-lose if they decide to go to court instead). In this scenario, **SmartSettle** has already found a solution that satisfies both parties, definitely win-win. To take you "beyond win-win" **SmartSettle** goes one more step and generates **Improvement 7**. **Improvement 7** has a higher rating for both parties than **Equivalent 6**. Since both parties consider this new package better, it replaces **Equivalent 6** and becomes the final outcome (Fig 25 and Fig 40).